521 M7280 – SATELLITE GEODESY

SPRING SEMESTER 2017

Lab No. 7

handed out Wednesday, April 26, 2017
due Wednesday, May 10, 2017, 09:10 **Name:** _____

Satellite Orbit in 3-D Space (II) Creating your own SP3 files

1. From a GPS satellite almanac (satellite ID = your date of birth) that is given to you, please write a Matlab program which computes the satellite's orbit every 5 min for a 48-hour period.

   a. List your results in both an initial frame and ECEF Cartesian frame with 7 columns (time, Xin, Yin, Zin, x, y, z).
   b. Plot the satellite's position in two 3-D maps (one for inertial and the other for ECEF Cartesian).
   c. What are the six Keplerian elements you use to compute the orbit?
   d. What are the period and mean motion of your satellite?

2. Convert your ECEF Cartesian coordinates into the ECEF spherical frame.

   a. List the results in a table with 4 columns (time, longitude, latitude, height).
   b. Plot in a 2-D map for the longitude, latitude, and height values as functions of time.

3. Check your results with that from a real SP3 file. Discuss your results.

Note: GPS almanac files (in the YUMA format) can be found through the following link: *http://www.navcen.uscg.gov/?pageName=gpsAlmanacs*

Use for $\boldsymbol{GM} = 398600.4418\left(\mathrm{km}^3/\mathrm{s}^2\right)$, $\omega_e^* = 7292115.8553\times10^{-11}\left(\mathrm{rad/s}\right)$, $\omega_e = 7292115\times10^{-11}\left(\mathrm{rad/s}\right)$, and $\boldsymbol{R} = 6371.000000\left(\mathrm{km}\right)$.

Your (individual) final report should contain (use A4 papers):

- this page as the cover sheet
- source code(s) and outputs; do not forget to add your name and lots of comment cards to the source listing (% .....)
- input and output files from program [input/output values used and calculated], if any
- plots, including captions on axes, title, your name, LB#/HM#, course title, date (if any)
- derivation and description of formulas used, accompanied by figures where applicable
- evidence of computational accuracy
- discussion of results